

## CLAIMS

1. A filament or fibre (2) comprising:  
5 a volume modulation colouration producing substance (6);  
containment means (8) for containing the substance in the form  
of an elongated core which containment means is at least partially light  
transmitting; and  
10 stimulation means (4) for stimulating the substance to produce a  
change in the volume of the substance, thereby changing the colour of the  
filament or fibre.
2. A filament or fibre as claimed in Claim 1 wherein the substance  
comprises a volume modulation colorant.
- 15 3. A filament or fibre as claimed in Claim 2 wherein the volume  
modulation colorant comprises artificial pigment cells.
- 20 4. A filament or fibre as claimed in Claim 2 or Claim 3 wherein the  
volume modulation colorant comprises polymer gel particles, which particles  
are immersed in an aqueous solution, the polymer gel particles and aqueous  
solution together forming the substance.
- 25 5. A filament or fibre as claimed in Claim 3 wherein the polymer gel  
particles have a diameter falling within the range of 5 to 100 µm.
6. A filament or fibre as claimed in any one of Claims 4 or 5 wherein  
the concentration of polymer gel particles is between 5 and 40 wt%, and the  
gel solid content is in the range of 1 to 10 wt%.
- 30 7. A filament or fibre according to any one of the preceding claims  
wherein the containment means (8) comprises an outer sheath.

8. A filament or fibre according to Claim 7 wherein the outer sheath is transparent.

9. A filament or fibre according to Claim 7 or Claim 8 wherein the outer sheath is formed from a flexible polymer.

10. A filament or fibre according to any one of Claims 2 to 9 wherein the stimulation means comprises heating means for heating the substance, and the volume modulation colorant is of the type having a volume that changes with temperature.

11. A filament or fibre according to Claim 10 wherein the heating means comprises an inner electrode (4) extending substantially axially through the elongate core.

12. A filament or fibre according to Claim 10 or Claim 11 further comprising means for causing an electrical current to flow through the heating means.

13. A filament or fibre according to Claim 11 or Claim 12 wherein the inner electrode (4) is spaced apart from the containment means by tens of  $\mu\text{m}$  to hundreds of  $\mu\text{m}$ , typically 100 $\mu\text{m}$ .

14. A filament or fibre according to any one of Claims 2 to 9 wherein the stimulation means comprises electric means (22, 24) for applying an electric field across the substance, and the volume modulation colorant is of the type having a volume that changes with electric field.

15. A filament or fibre according to Claim 14 wherein the electric means comprise a pair of outer electrodes (22, 24) each extending along an outer surface of the elongate core, the filament or fibre further comprising an at

least partially light transmitting isolating coating (28) at least partially enclosing the electrodes.

16. A filament or fibre according to Claim 15 wherein the outer electrodes (22, 24) are entwined, and extend substantially helically along the core.

17. A filament or fibre according to Claim 14 wherein the electric means comprises an inner electrode (42) extending substantially axially along the core, and the containment means, which containment means comprises an outer electrode (46), the filament or fibre further comprising a light transmitting isolating coating (48), at least partially enclosing the outer electrode.

18. A filament or fibre according to Claim 17 wherein the outer electrode (46) comprises a conductive polymer.

19. A filament or fibre according to Claim 17 or Claim 18 wherein the outer electrode (46) is transparent.

20. A filament or fibre according to any one of Claims 17 to 19 wherein the outer electrode (46) is flexible.

21. A filament or fibre according to Claim 15 further comprising an inner electrode extending axially through the elongated core.

25 22. A filament or fibre according to any one of the preceding claims further comprising spacer means.

30 23. A filament or fibre according to Claim 22 wherein the spacer means comprises one or more spacer wires (72) extending substantially axially through the core.

24. A filament or fibre according to Claim 22 wherein the spacer means comprises a plurality of substantially spherical beads (90).

25. A filament or fibre according to Claim 24 wherein the substantially spherical beads are contained within the substance (6).

26. A filament or fibre according to Claim 11 or Claim 21, or any claim dependent on Claim 11 or Claim 21 wherein the spacer means are positioned between the inner electrode (4) and the containment means (8).

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27. A filament or fibre according to Claim 15 or Claim 17, or any claim dependent upon Claim 15 or Claim 17 wherein the spacer means are positioned between the inner electrode (4) and the one or more outer electrodes (46).

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28. A filament or fibre according to Claim 26 or Claim 27 wherein the spacer means comprises one or more spacer wires extending helically along the inner electrode.

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29. A filament or fibre according to Claim 26 or Claim 27 wherein the spacer means comprise substantially spherical beads deposited on the inner electrode.

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30. A filament or fibre according to any one of Claims 22 to 29 wherein the spacer means are formed from a non-conductive material.

31. A filament or fibre according to Claim 11 or Claim 21 or any claim dependent on Claim 11 or Claim 21 further comprising a colour layer on the inner electrode (4).

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32. A garment formed from a plurality of filaments or fibres according to any one of the preceding claims.

33. A textile formed from a plurality of filaments or fibres according to any one of the preceding claims.

5        34. A method of forming a fibre or filament comprising the steps of:  
      forming a containment means for containing a volume modulation  
      coloration producing substance in the form of an elongate core;  
      associating with the containment means a stimulation means for  
      stimulating the volume modulation coloration producing substance; and  
10        adding a volume modulation coloration producing substance to a space  
      defined by the containment means; and  
      sealing the containment means.

15        35. A method according to Claim 34 wherein the step of forming the  
      containment means, and the step of associating the stimulation means with  
      the containment means are combined into a single step comprising co-  
      extruding a conductive material in the form of a central elongate core with a  
      non-conductive material in the form of a first hollow elongate portion  
      surrounding the conductive elongate core, and a second coaxial hollow  
20        elongate portion spaced apart from the first elongate portion, the first elongate  
      portion and the second elongate portion being joined by one or more radially  
      extending sections extending from the first elongate portion to the second  
      elongate portion.

25        36. A method according to Claim 35 comprising a further step of  
      depositing on an outer surface of the outer elongate portion, a transparent  
      conductive layer.

30        37. A method according to Claim 36 comprising a further step of  
      depositing on an outer surface of the transparent conductive layer, a  
      transparent protective and isolating coating.